

# **Report for 2001WV2981B: Aquaculture Waste Control and Optimizing Nutrient Utilitization Trough Diet Composition and Feeding Strategies**

There are no reported publications resulting from this project.

Report Follows:

## **" ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS"**

### **PROJECT SPECIFICATIONS:**

**Subcontract No. 68-211-WVSC**

**Project Sponsor: U.S. Geological Service**

**Project Title:** Aquaculture Waste Control and Optimizing Nutrient Utilization through Diet Composition and Feeding Strategies" for the FY 2001.

**Period of Performance:** March 1, 2001 to February 28, 2002

### **SUMMARY**

The present report provides an update of the annual accomplishments for the project titled " Aquaculture Waste Control and Optimizing Nutrient Utilization through Diet Composition and Feeding Strategies" for the FY 2001.

### **STATEMENT OF PROBLEMS:**

The ultimate source of wastes in an aquaculture system is feed; and phosphorus and nitrogen are the major elements of concern in discharge from aquaculture operations. The source and amount of the nutrients in the feed, daily feeding rate and the amount of feed wasted in the ponds or raceways influence the amount of unretained nitrogen and phosphorus in the salmonid culture systems. Therefore, minimizing the allowances of the nutrients in the feed, increasing bioavailability of these nutrients to the fish, and more efficient feeding of the fish, offer opportunities to reduce the unretained nutrients in the culture systems. Consequently, reducing phosphorus and nitrogen load in aquaculture effluent can be most effectively implemented by increasing the retention of the nutrients by fish. Most emerging trout farmers in West Virginia feed 1.5 to 2 kg of feed for each kg of fish harvested. This suggests that a great amount of the nutrients are wasted in commercial culture operations. Reasons for poor efficiency in nutrient retention in commercial culture operations are not clear. Feeding practices vary considerable among farmers, some feed on restricted basis, and some try to feed to satiation, while some inadvertently over-feed because of lack of knowledge of what the fish will consume. Reducing aquaculture waste loads and optimizing nutrient utilization through diet composition and feeding strategies will allow for increased production,

increased profits for producers (small- and large-scale), and possibly offer more affordable foods for the consumers.

Therefore, there is the need to reduce aquaculture wastes and improve nutrient utilization through diet formulation and appropriate feeding strategy or practice.

This research will provide information on the bioavailability of different chemical forms of phosphorus to determine the optimum phosphorus allowance in commercial feeds and make accurate estimates of phosphorus budgets in aquaculture systems. Also, this research will evaluate the potential effects of various forms of zeolites (crystalline, hydrated aluminosilicate of alkali and alkaline earth cation) on nutrient utilization as well as their ability to remove ammonia and nitrite toxicity in aquaculture systems. Furthermore, one phase of this proposed study will compare nitrogen and phosphorus loads in aquaculture systems under various feeding regimens to determine how much improvement in feeding practices can reduce the waste loads in the systems.

### **RESEARCH OBJECTIVES:**

1. Determine effects of feeding practices on waste load in trout culture systems.
2. Evaluate the effects of different chemical forms of phosphorus on net absorption of phosphorus and orthophosphate concentrations in tank water effluents.
3. Determine the effects of dietary supplementation of various zeolites on ammonia and nitrite concentrations in trout rearing system.
4. Determine the effects of dietary supplementation of various zeolites on growth, feed efficiency and health of rainbow trout.
5. Determine the economic impact of changes in feed formulation and feeding practices.

### **PROGRAM STATUS:**

The first year's study would have been the determination of the effects of feeding practices on waste load in trout culture systems (Objective 1) and the evaluation of the effects of different chemical forms of phosphorus on

net absorption of phosphorus and orthophosphate concentrations in tank water effluents.

The experimental diets for study 1 (objective 1) were formulated and two thousand year-1 rainbow trout averaging 20 g were obtained from High Appalachia Trout Inc. Forty fish were stocked into each of the 36 twenty-nine gallons glass aquaria. The water temperature was to be maintained at 15 °C. The experiment was terminated after the water temperature control system failed and 100% mortality recorded. The water temperature rose to 27 °C (trout is coldwater fish and optimum temperature for growth of trout ranges 12-15 °C and not higher than 18 °C) and the dissolved oxygen level dropped too low to support the fish.

### **PRINCIPAL FINDINGS AND SIGNIFICANCE OF FINDINGS:**

The work is not sufficiently mature to show principal findings and their significance this time.

### **PUBLICATIONS:**

The project has not progressed to the point of publishing research findings. Only preliminary data is available but insufficient to support to support any scientific evidence.

### **AWARDS AND ACHIEVEMENTS:**

No award or achievement recorded at this time because of the delay in the commencement of study 1.

### **INFORMATION TRANSFER SYSTEM:**

The project has not progressed to the point of making research findings available to the public.

### **STUDENT SUPPORT:**

One student was involved in the preparation of the experimental diets and taking care of the fish within the first week of the arrival of the fish to Aquaculture wet laboratory.

## **PLANS FOR YEAR 2:**

The first year's studies were not conducted because of the problems mentioned above. Objectives 1 and 2 will be carried over and out in the second year. I am requesting an extension for objectives 3, 4 and 5 to be completed in the third year.

Because of the aforementioned problems, only some expenses including the purchase of fish, materials and supplies, and payment of student worker have been drawn from the account.

## **PROGRESS AND SETBACKS:**

The first year's study would have been the determination of the effects of feeding practices on waste load in trout culture systems (Objective 1) and the evaluation of the effects of different chemical forms of phosphorus on net absorption of phosphorus and orthophosphate concentrations in the tank water effluents.

The experimental diets for study 1 (objective 1) were formulated and two thousand year-1 rainbow trout averaging 20 g were obtained from High Appalachia Trout Inc. Forty fish were stocked into each of the 36 twenty-nine gallons glass aquaria. The water temperature was to be maintained at 15 °C. The experiment was terminated after the water temperature control system failed and 100% mortality recorded. The water temperature rose to 27 °C (trout is coldwater fish and optimum temperature for growth of trout ranges 12-15 °C and not higher than 18 °C), and the dissolved oxygen level dropped too low to support the fish.

To correct the design flaw, an engineering firm was contracted to design a system that can maintain the temperature of water in the ranges of 10-20 °C. Also, air-cooling system was to be designed that can maintain the room temperature to that of the water temperature to minimize net gain or loss of heat. Based on the engineer's recommendation, both air and water chillers have been purchased and a local contractor is currently installing the designed system to correct the problem.

After the completion of the installation of the temperature control system that will be in mid of April 2001, a trial run will be conducted before objective 1 is started to ensure that the system works to the specification.